Constraints on the Disposal of Detergent Manufacturing Waste

R.H. WENDT, The Procter and Gamble Co., Packaged Soap and Detergent Division, Cincinnati, OH 45217

ABSTRACT

The needs of the detergent industry in the 1980s will require the management of many new regulatory and environmental concerns. The rules and regulations on waste disposal are changing rapidly and are likely to have an ever increasing impact on manufacturing processes. An understanding of the current constraints in disposal of waste will minimize the cost and future problems in this aspect of detergent manufacture. In a broader sense, the detergent industry needs to be continually aware of the concerns within governmental agencies, to be informed on proposed regulations that address these concerns and to provide input into the regulatory process. The detergent industry needs to help regulatory agencies resolve their concerns in such a way that restrictions and costs are minimized.

INTRODUCTION

Disposing of waste from a manufacturing plant is a major concern for many companies. And, without recognition of governmental regulations concerning waste disposal, the best efforts in product development and marketing can be delayed substantially. But, by understanding these constraints, company operations can move ahead smoothly.

This paper describes constraints that apply to the disposal of waste from the manufacture of detergent products. The emphasis will be on solid waste disposal, although air emissions and sewered waste are also discussed. Constraints on waste disposal are primarily by regulations of government agencies. The most recent regulation affecting the soap and detergent industry is RCRA, the Resource Conservation and Recovery Act, and its impact on detergent manufacturing will be emphasized.

As these regulations are reviewed, manufacturers must remember that they always have a responsibility to dispose of wastes safely, even when rules and regulations do not restrict their choices. Quite clearly, RCRA and other regulations of today were, at least in part, responsibilities in the past. Responsibilities of today may well become legal requirements in the future, and may even be retroactive to today's actions. Manufacturers need economical and safe ways to dispose of waste.

Air Emissions

Air emissions are regulated primarily by the Clean Air Act as amended in 1977 and are administered by the EPA and by State Agencies. The soap and detergent industry may be considered to be a "chemical processor" and therefore may be one of the 28 major stationary source groups identified in the 1977 amendments.

One aspect of air emissions involves dust control from the handling of raw materials and finished products. To manage this dust, bag filters and cyclone filters are commonly used which allow recovery and reuse of the materials being handled.

Air pollutants include sulfur dioxide, carbon monoxide, nitrogen oxides, particulates, and hydrocarbons, and are regulated by issuance of permits. Air pollution permits are required for most soap and detergent plants, and the location of the plant determines the difficulty in obtaining a permit. If air pollution in the vicinity of the plant is within acceptable limits, then some incremental increase is allowed for new plants and for the expansion of existing plants. If air pollution in the vicinity of the plant area is not within acceptable limits, the region is considered to be a Non-Attainment Area. In Non-Attainment Areas, state implementation plans restrict both new plants and the expansion of existing plants. In these areas, new and expanded major sources of air pollutants must meet very strict requirements. These requirements include (a) attaining the lowest achievable emission rate at the new facility, (b) obtaining emission offsets from other sources, (c) demonstrating a net improvement in air quality by these first two considerations, and (d) certifying that all other company-owned sources in that state are in compliance. In addition, the EPA is due to develop New Source Performance Standards for the detergent industry by mid-1982. These regulations will set federal standards for new or modified plants.

Thus, regulations concerning air emissions obviously make the expansion of a plant a difficult process. Even a cost-saving project, such as the conversion from oil-fired to coal-fired boilers, could require one year of ambient-air monitoring data for all significant pollutants in the vicinity of the plant, followed by modeling to demonstrate the impact of the change on the environment. This monitoring and modeling must be completed in order to apply for a permit, requiring perhaps two and one-half years of lead time before construction can begin. Clearly, the regulations concerning air emissions are significant to the detergent industry, especially in planning new or modified facilities.

Sewered Waste

Wastewaters from manufacturing are normally disposed of in a sanitary sewer. This type of disposal has undoubtedly been practiced for years by most plants and normally presents no major problems. Restrictions on wastewater discharges are generally established by the Clean Water Act and by municipal ordinances on sewage treatment. In general, these restrictions are designed to prevent industrial waste from interfering with the sewage treatment of conventional pollutants.

Conventional pollutants are designated by the U.S. EPA as BOD, total suspended solids, pH, and dissolved animal and vegetable fats, oils and grease. Municipal agencies normally do not restrict the amounts of conventional pollutants in wastewater, although they do impose pH limits. However, the cost of sewerage to the plant is usually based on the volume of water and on the concentrations of BOD and suspended solids. Overall, sewering is usually the easiest and cheapest way to dispose of detergent-plant waste, where technically and legally feasible.

Municipal ordinances and EPA regulations invariably restrict the sewering of wastes that may interfere with sewage treatment. These regulations prohibit wastes that create a fire or explosion hazard (e.g., gasoline, flammable solvents, paint), although small amounts of water-soluble solvents do not cause problems. Also prohibited are wastes that might plug or otherwise impair the hydraulic capacity of the sewers (e.g., sand, ashes, tar, grease). In addition, wastes that inhibit the bacterial organisms used in the treatment process (e.g., heavy metals, mineral acids, toxic chemicals) must be avoided, as well as wastes that may damage the sewer system. For example, discharges outside the pH range of 6-9 or temperatures of wastewater above

150 F may damage the sewer pipes and usually are prohibited.

Several approaches may be used to avoid problems with sewered wastes. For example, storage facilities for liquid materials should have spill protection so that leaks and spills cannot enter streams or sewer systems. Wastewater that is too acidic or too alkaline to be sewered can often be neutralized by another waste stream. Another technique to reduce interferences in sewage treatment is to use fat traps or settling tanks. Floatable fats and settled solids are separated for recovery or for disposal in a landfill.

Special restrictions also may exist at individual sewage treatment plants. For example, a local treatment plant may be operating over capacity and therefore may be forced to limit the discharge of even conventional pollutants. In this case, the detergent plant may have to pretreat its wastewaters. Even in a treatment plant operating within its capacity, a large detergent plant could temporarily interfere with normal sewage treatment. For example, a batch of off-quality surfactant or finished product might be legally discarded by sewering. However, if sewered too rapidly, excessive foaming may occur in the sewer system or at the treatment plant. For that reason, each detergent plant should know the capacity of the sewage system that serves it and should calculate at what rate waste materials can be sewered without creating problems.

Wastewater regulations need not be considered as only problems or constraints; they also may represent opportunities for cost-saving projects. For example, process-equipment wastewater can be collected for re-use or for incorporation into products. Another cost-saving project might involve periodic sampling and analysis of wastewater to determine if valuable materials are being wasted. More specific analyses may then identify the materials and locate the source. Such programs may decrease both the sewer charges and the loss of materials.

Soap and detergent plants that discharge any wastewater directly into navigable waters must obtain federal or state discharge permits based on EPA effluent guidelines. Such direct discharge of wastewater is unusual in our industry except for rainwater and clean cooling water.

A special category of water pollutant is an EPA list of 129 materials called toxic or priority pollutants. The list includes heavy metals, chlorinated organics and other specific organic compounds such as phenol, as well as cyanide and asbestos. When soap and detergent wastewaters were surveyed by the EPA, none of these toxic pollutants was found in significant concentrations. Therefore, our industry is not expected to be required to pretreat wastewater for removal of toxic pollutants.

The list of toxic pollutants is not fixed; it may be changed. For example, the EPA recently proposed that ammonia be considered a toxic pollutant. However, at the moment, it seems unlikely that the proposal will be enacted. But, such a proposed change in EPA regulations is a good example on which to review one's degree of awareness of environmental and regulatory issues.

The proposal to consider ammonia as a toxic pollutant would have affected many plants, including detergent plants. Assuming that a plant uses ammonia or ammonium salts, consider these questions: (a) were you aware of the proposed regulation; (b) did you evaluate its effect on your plant; (c) did you inform anyone, such as trade associations or the EPA, of the problems and costs of compliance?

Government agencies need information from industry in order to promulgate cost-effective regulations. To ensure that one's interests are considered when new rules are proposed, be informed and contribute to the regulatory process.

Solid Waste

The newest constraints in handling detergent manufacturing waste are related to RCRA, the Resource Conservation and Recovery Act, for which final regulations were published in May 1980. With few exceptions, RCRA regulates all wastes except those wastes that are already regulated by the Clean Air Act or the Clean Water Act. The first step for a plant is, therefore, to prepare an inventory of wastes and the EPA permits under which they are regulated. RCRA carefully defines and distinguishes between "solid waste" and "hazardous solid waste." The definitions and distinctions of this act have a significant effect on detergent manufacturers and need to be defined in greater detail.

First, the regulations will be described in sufficient detail so that nonhazardous and hazardous solid waste can be distinguished. Then, common detergent-making operations will be discussed where solid wastes are often generated. Although this review cannot anticipate the specific aspects of individual plants, it may be able to provide the guidance needed to simplify the tasks of compliance.

Solid waste is virtually any discarded material that is not emitted into the air or sewered or directly discharged to a stream. The majority of the solid waste from a detergent plant will be nonhazardous materials such as empty bags, fiber drums, carton board, plastic bottles and unusable scrap products. Normally these wastes are simply compacted and taken to a dump. Under RCRA, even nonhazardous solid waste cannot be taken to an open dump; only sanitary landfills are allowed. Even on-site disposal facilities must now be operated as sanitary landfills. Manufacturing waste can no longer be simply dumped out on the "back forty."

RCRA primarily deals with hazardous waste. According to the 1980 regulations, a hazardous waste is, by definition, any of the following: any one of 16 nonspecific materials, or any of 69 listed specific materials, none of which is common to the soap and detergent industry; also included are any of 239 specific toxic wastes if discarded at a total rate exceeding 1,000 kg/month. Many common chemicals, if discarded, are considered toxic wastes, such as acetone, methanol, most chlorinated solvents, asbestos, benzene, xylene and toluene. Finally, hazardous waste includes any of 122 acutely hazardous wastes if discarded at a rate exceeding 1 kg/month. Most of these acutely hazardous materials are not common in the detergent industry although some may be found in plant quality-control laboratories. For all acutely hazardous wastes, even the empty containers are considered to be hazardous waste if the container is larger than 20 liters or if the inner liner exceeds 10 kg, unless the container or liner is triple-rinsed before disposal.

Many of the acutely hazardous wastes on the RCRA list are pesticides. However, two materials on the list are surprising; propylene glycol and oleyl alcohol condensed with 2 moles ethylene oxide, apparently are on the list by mistake.

So far, the identification of hazardous waste has been straightforward: if the discarded material is on one of these four lists, it is a hazardous waste. Very few, if any, raw materials used in detergent manufacturing are on these lists. However, materials may still be a hazardous waste if they are either ignitable, corrosive, reactive, or "extraction-procedure" toxic. Many raw materials used in detergent manufacture meet one of these criteria and therefore, if discarded, would be a hazardous waste. Most manufacturers have occasional problems with spills or off-quality materials or residues from tank clean-outs. The following paragraphs describe the properties that may cause a waste to be classified as hazardous.

If a waste is ignitable, it is considered hazardous. Ignitable means a liquid with a flashpoint below 60 C, a material that may ignite spontaneously, an ignitable compressed gas, or an oxidizer. These definitions are somewhat different than DOT regulations on flammable and combustible materials, although a DOT flammable material is certainly a RCRA ignitable material. Some detergent raw materials, if discarded as solid waste, may be ignitable. These include ethanol, other short-chain alcohols, perfumes, α-olefins (before sulfonation), and hydrocarbon propellants. Other possibilities are short-chain methyl esters and, of course, finished aerosol products with flammable propellant mixtures. One important exemption applies to detergents: RCRA does not consider "an aqueous solution containing less than 24% alcohol" to be ignitable. Therefore, liquid detergent finished products containing alcohol are not likely to be classified ignitable even if they flash below 60 C.

A good source of information about ignitable materials is the Department of Transportation Hazard codes. This information is readily available for any purchased chemical and is also a good source of basic information about the next categories of corrosiveness and reactivity.

If a waste is corrosive, it is considered hazardous. Corrosive wastes include liquids that corrode steel above a certain rate, or any aqueous waste that is outside the pH range of 2-12.5. Obvious materials in this class would be any concentrated acid or caustic solutions as well as acetic acid and some surfactants when handled as solutions. Some short-chain fatty acids also are corrosive as well as some amides, amines and silicates.

If a waste is reactive, it is considered hazardous. Reactivity is a property of solid wastes that are unstable, react violently with water or become hazardous when mixed with water. Very few materials used by the detergent industry would be considered reactive except those that are also corrosive such as oleum, sulfur trioxide and chlorosulfonic acid.

If a waste is "extraction-procedure" toxic, it is considered hazardous. "Extraction-procedure" or EP toxic materials are those whose extracts contain excessive amounts of eight metals or six pesticides. Pesticides are unlikely to be present in our wastes, although chemicals purchased for insect or rodent control around a plant, and then discarded, are probably hazardous waste. For solid waste, the extraction procedure involves contact with acetic acid at pH 5 and 20-fold dilution. Very likely, solid raw materials commonly used in detergent manufacture will contain less than the specified limits of these metals. However, liquid materials are to be tested for metal content without dilution, and therefore, concentrated solutions might contain trace metals in excess of these limits. The supplier of these materials probably will know if the material would be considered hazardous as a waste.

Other than raw materials, a special type of manufacturing waste are maintenance supplies such as spent lubricating oil, solvents and paints. Spent lubricating oil, especially oil from an engine using leaded gasoline, is probably EP toxic. However, oil that is sent to a recycling center is not being discarded, and perhaps will not be regulated by RCRA. The EPA is due to make a decision on spent lubricating oils by late 1980 and perhaps will clarify the status of these waste maintenance supplies.

A waste is considered hazardous according to RCRA if it is on one or more of the four lists, or if it is ignitable, corrosive, reactive or "extraction procedure" toxic. The four lists are easy to check, but the other four properties are not as easy to measure.

In order to determine if a waste is ignitable, corrosive, reactive or EP toxic, tests may be performed as specified in RCRA. Contract laboratories are available to perform these tests if in-house testing is not possible. However, generators of waste also may use their knowledge of the waste to declare that it is not hazardous. If so, the generator is responsible for that decision. Since a nonhazardous waste is likely to be sent to a state-supervised facility where testing may be performed, the decision by the generator not to test involves some risk. It seems prudent under those circumstances for waste generators to have documentation to support their claim of nonhazardous and to keep a retained sample in case of a challenge.

The lists of toxic and acutely hazardous wastes that are included in RCRA will expand as additional toxic chemicals are identified. The EPA already has proposed 18 additional materials as hazardous wastes. In addition, a major federal program, called the National Toxicology Program, is testing about 600 materials for chronic toxicity. Compounds in this Program that are of interest to the detergent industry include:

Boric acid
Diethanolamine
Dodecyl alcohol, ethoxylated
Sodium aluminosilicate
Sodium dodecyl sulfate
Ethyl alcohol
Xylene
Chlorinated trisodium phosphate
Dimethyldodecylamine oxide
Lauric acid diethanolamine
Sodium cyanurate
Xylene sulfonic acid, sodium salt
Toluene
Ethylene glycol

Depending on the results of these tests, new regulations may be proposed for the materials listed at some time in the future.

The hazardous waste regulations under RCRA obviously are complicated. However, several exemptions exist that may simplify meeting the requirements of RCRA.

For example, point source discharges covered by NPDES permits are exempted. The discharge itself is not regulated by RCRA, although industrial wastewater going into a holding pond before discharge may be regulated by RCRA. Also, fly ash waste, bottom ash waste, slag waste and flue gas emission control waste from burning of fossil fuels are exempt from RCRA. Also excluded from RCRA are wastes that are re-used or recycled in a legitimate and beneficial manner. However, the EPA is expected to promulgate further regulations covering re-used and recycled wastes in late 1980.

As previously cited, companies that generate or accumulate less than 1,000 kg/month of total hazardous waste (except for acutely hazardous waste) are exempt from most generator regulations. The small-quantity exemption allows the disposal of small amounts of hazardous waste without the special permits or manifests normally required by RCRA. However, the generator must still properly dispose of the wastes in an approved facility. Small amounts are defined as 1,000 kg hazardous wastes, or 1 kg of acutely hazardous wastes, or the containers of acutely hazardous wastes if 20 liters or less, or the inner liners from containers of acutely hazardous wastes if 10 kg or less, or the clean-up residue from a spill of acutely hazardous waste if 100 kg or less, in one calendar month.

In order to qualify for this exemption, wastes will need to be carefully segregated according to their classification. And, if hazardous waste generation exceeds the limit only

one month in a year, then an EPA identification number must be obtained before that month's waste can be transported or discarded.

This exemption probably is temporary; the EPA has indicated that it intends to decrease the exclusion level to 100 kg within 2-5 years. Therefore, avoidance of the RCRA regulations as a small-quantity generator is probably temporary, if possible at all.

Assume that a detergent plant has somehow generated a hazardous waste and wants to dispose of it. The first task is to locate a waste facility that will acept the waste. Very likely, the facility will ask for a description of the waste and will then ask the EPA for approval to accept the waste. This procedure may require several weeks, but eventually a waste facility will be found and a transporter can be hired.

With an EPA identification number as a generator, a manifest can be prepared for the transporter. This manifest must include the company name, address, phone number, and EPA number of each transporter and the designated facility for storage, treatment or disposal. In addition, the proper shipping name required by the Department of Transportation and the quantity of material must be listed. Each container must also be constructed, labeled and marked in accordance with DOT regulations.

The concerns of the generator do not end when the transporter leaves the plant. If the transporter has an accident, the generator may become involved even though he is not legally responsible. If the transporter is not able to deliver the waste as directed, the generator may be asked to find an alternative facility. If the generator does not receive confirmation of delivery from the designated facility within 35 days, a special effort must be made to locate the waste. Another possibility might be the loss of a permit by the designated facility after accepting the waste. Again, the generator may not be legally responsible for that waste, but adverse publicity could obligate the company to take back the waste. All of these possibilities indicate that transporters and designated facilities should be selected with care and should be audited periodically to avoid future problems.

Even nonhazardous waste may become more difficult to discard because of the RCRA. Waste facilities are becoming very cautious and may insist on testing to verify that your waste is not ignitable, corrosive, reactive, or EP toxic. After testing, the waste facility may ask for EPA advice on handling the waste. Therefore, any unusual waste may be difficult to dispose of and require greater time and effort than before RCRA was enacted.

Future Constraints

What are the future trends in waste disposal that might affect the detergent industry? The emphasis by the U.S. EPA apparently is on protection of drinking water and ground-water supplies. RCRA certainly is a step in that direction, and even more legislation seems likely. Two approaches are probable. First, new regulations may be proposed that will permit governmental agencies to clean up water supplies that have become contaminated. Clean-up techniques probably will involve activated-carbon filtration where appropriate and stopping the source of contamination when identified. If a plant is found to be causing or contributing to pollution of ground-water, it may be required to pay the costs of the clean-up. A second possible set of new regulations may substantially restrict the use of pits, ponds and lagoons for storage or disposal of liquid waste in order to prevent leaching of pollutants into ground-water. These trends in future constraints may not have a major impact on the detergent industry although it is only prudent to be aware of all proposed regulations by the EPA.